INTERNATIONAL RECOMMENDATION

OIML R 60-3

Edition 2017 (E)

Metrological regulation for load cells

Part 3: Test report format

Réglementation métrologique des cellules de pesée

Partie 3 : Format du rapport d'essais

OIML R 60-3 Edition 2017 (E)

ORGANISATION INTERNATIONALE DE MÉTROLOGIE LÉGALE

INTERNATIONAL ORGANIZATION OF LEGAL METROLOGY

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Foreword

The International Organization of Legal Metrology (OIML) is a worldwide, intergovernmental organization whose primary aim is to harmonize the regulations and metrological controls applied by the national metrological services, or related organizations, of its Member States. The main categories of OIML publications are:

- **International Recommendations (OIML R),** which are model regulations that establish the metrological characteristics required of certain measuring instruments and which specify methods and equipment for checking their conformity. OIML Member States shall implement these Recommendations to the greatest possible extent;
- **International Documents (OIML D),** which are informative in nature and which are intended to harmonize and improve work in the field of legal metrology;
- **International Guides (OIML G),** which are also informative in nature and which are intended to give guidelines for the application of certain requirements to legal metrology;
- **International Basic Publications (OIML B),** which define the operating rules of the various OIML structures and systems; and

OIML Draft Recommendations, Documents and Guides are developed by Project Groups linked to Technical Committees or Subcommittees which comprise representatives from OIML Member States. Certain international and regional institutions also participate on a consultation basis. Cooperative agreements have been established between the OIML and certain institutions, such as ISO and the IEC, with the objective of avoiding contradictory requirements. Consequently, manufacturers and users of measuring instruments, test laboratories, etc. may simultaneously apply OIML publications and those of other institutions.

International Recommendations, Documents, Guides and Basic Publications are published in English (E) and translated into French (F) and are subject to periodic revision.

Additionally, the OIML publishes or participates in the publication of **Vocabularies (OIML V)** and periodically commissions legal metrology experts to write **Expert Reports (OIML E)**. Expert Reports are intended to provide information and advice, and are written solely from the viewpoint of their author, without the involvement of a Technical Committee or Subcommittee, nor that of the CIML. Thus, they do not necessarily represent the views of the OIML.

This publication – reference OIML R 60-3:2017 – was developed by Project Group 1 of OIML Technical Subcommittee TC 9 *Instruments for measuring mass and density*. It was approved for final publication by the International Committee of Legal Metrology at its 52nd meeting in October 2017 and will be submitted to the International Conference on Legal Metrology in 2020 for formal sanction. It supersedes the previous version of R 60 dated 2000.

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Part 3 Test report format

1 Introduction

1.1 This Report Format applies to any kind of load cell (independent of its technology). It presents a standardized format for the results of the various tests and examinations, described in OIML R 60-2, to which a type of load cell shall be submitted for the purpose of its approval based on this OIML Recommendation.

1.2 It is recommended that all metrology services or laboratories evaluating and/or testing types of load cells according to OIML R 60-1, or to national or regional regulations based on this Recommendation, use this Report Format, directly or after translation into a language other than English or French. In the case of a translation, it is highly recommended to leave the structure and the numbers of the clauses unchanged: in this case, most of the content is also understandable for those who cannot read the language of the translation.

1.3 Some of the tests may have to be repeated several times and reported using several identical sheets; therefore, report pages must be numbered in the space provided at the top of each page, completed by the indication of the total number of pages.

1.4 In the practical application of the Report Format, in addition to a cover page by the Issuing Authority, as a minimum, clauses A–F (as necessary) shall be included.

2 Applicability of this Report Format

In the framework of OIML B 18 *Framework for the OIML Certification System (OIML-CS)* applicable to load cells in conformity with OIML R 60-1 and R 60-2, use of this Report Format is mandatory, in French and/or in English with translation into the national languages of the countries issuing such certificates, if appropriate.

Implementation of this Report Format is informative with regard to the implementation of OIML R 60-1 and R 60-2 in national regulations.

2.1 Calculation procedures

2.1.1 In order to facilitate a comparison of the reports established in English and in French, the same abbreviations (those of the English language) are used in both versions; the meanings of these abbreviations are given whenever appropriate.

In testing and evaluating load cells for type evaluation, it is recognized that the test apparatus and practices used by the various laboratories will be different. OIML R 60 allows for these variations and still provides a method for testing, recording and calculating results that are readily understandable by other knowledgeable parties reviewing the data.

In order to achieve this ease of comparability it is necessary that those persons conducting the tests use a common system for recording data and calculating results.

Thus, it is essential that the calculation procedures below be reviewed and followed closely in the completion of this test report.

2.1.2 Load cell errors (E_L = Error Load test)

2.1.2.1 Complete a Table 6.3 for each test temperature, calculate the averages and record in the right hand column. When five runs are necessary, use Table 6.4.

2.1.2.2 Determine the conversion factor, f, which is the number of indicated units per load cell verification interval, v, and is used to convert all "indicated units" to "v". It is determined from the test data averages of the increasing load tests at the initial 20 °C nominal test temperature.

2.1.2.3 If a test load corresponding to 75 % of the measuring range for the load cell under test (i.e. 2 250 divisions for a 3 000 division cell, which is D_{min} plus 75 % of the difference between D_{max} and D_{min}) is not included in the test loads used in Table 6.3, interpolate between the adjacent upper and lower values of the averages of all three test runs and record in Table 6.5 (see R 60-2, 2.8.2).

2.1.2.4 Calculate the difference between the average indication on the increasing load test runs at 75 % of the difference between D_{max} and D_{min} and the indication at D_{min}. Divide the result (to five significant figures) by the number of verification intervals (75 % of n) for that load to obtain the conversion factor, f, and record in the tables that follow.

$$f = \frac{\text{average indication at } [D_{min} + 0.75 \cdot (D_{max} - D_{min})]}{0.75 \cdot n}$$

The units of conversion factor f are indicated units (e.g. digits or counts) per load cell verification interval v.

2.1.2.5 Enter the average test indications of the tests at the temperatures following the initial test at a nominal 20 °C in Table 6.5. In recording this data, indicate a "no test load" indication (at D_{min}) as "0". This may require subtracting the "no load indication at D_{min}" from the "test load indication" so that the first entry in the column is "0". These "0's" have been preprinted on the form to clarify that a dead load condition is recorded as "0".

2.1.2.6 Calculate the reference indication, R_i, by converting the net test load, in mass units, to indicated units (e.g. counts or digits), by multiplying by the conversion factor, f, for each test load and recording in the 2nd column in Table 6.5.

$$R_i = \frac{(\text{test load } i - D_{min})}{(D_{max} - D_{min})} \cdot n \cdot f$$

2.1.2.7 In Table 6.5 calculate the difference between the average test indication and the reference indication for each test load at each test temperature and divide the result by the conversion factor f to obtain the error, E_L, for each test load in terms of v.

$$E_L = (\text{average test indication for test load } i - \text{reference indication } R_i) / f$$

2.1.2.8 Compare E_L with the corresponding MPE for each test load.

2.1.3 Repeatability error (E_R in terms of verification interval v)

2.1.3.1 Enter data in Table 6.6.

2.1.3.2 Calculate the maximum difference between the test indications on Form 6.3 and divide it by f to obtain the repeatability error, E_R, in terms of the load cell verification interval v.

$$E_R = (\text{maximum indication of the test load} - \text{minimum indication}) / f$$

2.1.3.3 Compare E_R with the absolute value of the corresponding MPE for each test load.

2.1.4 Temperature effects on minimum dead load output (MDLO) (C_M = Change MDLO)

2.1.4.1 Enter in Table 6.7 the average indication for the initial minimum test load, D_{min}, for each test temperature from Table 6.3.

2.1.4.2 Calculate the difference between the average test indications for each temperature T_i in sequence and divide the result by the conversion factor f to obtain the change in terms of the load cell verification interval v.

$$C_M = (\text{average test indication at } T_2 - \text{average indication at } T_1) / f$$

2.1.4.3 Divide C_M by $(T_2 - T_1)$ and multiply the result by 5 for class B, C, and D load cells or 2 for class A load cells. This gives the change in v per 5 °C for class B, C, and D load cells or in v per 2 °C for class A load cells.

2.1.4.4 Multiply the result by $[(D_{max} - D_{min}) / n] / v_{min}$ to give the final result $C_M(v_{min})$ in units of v_{min} per 5 °C for class B, C, and D load cells, or in units of v_{min} per 2 °C for class A load cells. $C_M(v_{min})$ must not exceed p_{LC}.

$$C_M(v_{min}) = \frac{C_M \cdot (D_{max} - D_{min})}{n \cdot v_{min}}$$

$$p_{LC} \leq C_M(v_{min})$$

2.1.5 Creep magnitude $C_C(t)$ and minimum dead load output return (C_{DR})

($C_C(t)$ = Creep, expressed in terms of the load cell verification interval, v)

(C_{DR} = DR, expressed in terms of the load cell verification interval, v)

Remark: Contrary to the minimum dead load output return DR in terms of mass the minimum dead load output C_{DR} is expressed in terms of the verification interval v).

From the test indications recorded in Table 6.8, calculate the difference between the initial indication obtained at the minimum creep test load after the stabilization period and any indication obtained over the 30 minute test period with the maximum creep test load of 90 % to 100 % of E_{max} and divide by the conversion factor f.

$$C_C(t) = (\text{indication} - \text{initial indication}) / f$$

Remark: If the minimum creep test load or the maximum creep test load differ from D_{min} or D_{max} according to 2.1.2 "Load cell errors E_L" the conversion factor f must be recalculated with the minimum and maximum creep test loads (see 2.1.2.4).

2.1.5.1 C_C(t) must not exceed 0.7 times the absolute value of the MPE for the maximum creep test load at any time t over the 30 minute creep test period.

2.1.5.2 Calculate the difference between the test indications obtained at t = 20 minutes and t = 30 minutes after the initial indication at $t = t_0$ and divide by f to obtain the creep error, C_C (30 – 20), in terms of the load cell verification interval v.

$$C_C(30 - 20) = (\text{indication at time } t = 30 \text{ minutes} - \text{indication at time } t = 20 \text{ minutes}) / f$$

2.1.5.3 C_C (30 – 20) shall not exceed 0.15 times the absolute value of the MPE for the applied load.

2.1.5.4 Calculate the difference between the initial indication obtained at the minimum creep test load after the stabilization period (t_0 = 0 min) and the indication at the minimum creep test load after the creep test and after a time interval for stabilization (t > 30 min) and divide the result by conversion factor f to obtain the minimum dead load output return, C_{DR}, in terms of v.

$$C_{DR} = (\text{minimum test load indication2} - \text{minimum test load indication1}) / f$$

2.1.5.5 If the time intervals specified in R 60-2, Table 1 have been met, C_{DR} must not exceed 0.5 v.

2.1.5.6 If the actual time is between 100 % and 150 % of the specified time in R 60-2, Table 1, then the following applies:

$$C_{DR} \leq 0.5\,(1 - (x - 1))\,v$$

with

$$x = \text{actual time/specified time}$$

2.1.5.7 Whereas C_{DR} expresses the minimum dead load output return in terms of v, the value of DR as used in OIML R 76 [1] is expressed in units of mass (g, kg or t).

2.1.5.8 Calculate the minimum dead load output return, DR, expressed in units of mass (g, kg or t) as follows: $DR = (E_{max} - E_{min})\, C_{DR} / n_{LC}$

2.1.5.9 Regardless of the value declared by the manufacturer for the apportionment factor, p_{LC}, the MPE for creep shall be determined from R 60-1, Table 4 using the apportionment factor, p_{LC} = 0.7 (see R 60-1, 5.5.1).

2.1.6 Barometric pressure effects[1] (C_P = Change due to barometric pressure)

2.1.6.1 From the test indications recorded in R 60-3, Table 6.9, calculate the difference between the indications for each pressure and divide the result by conversion factor f to obtain the change, C_P, in terms of v.

$$C_P = (\text{indication at } P_2 - \text{indication at } P_1) / f$$

2.1.6.2 Divide C_P by ($P_2 - P_1$) to determine the change due to barometric pressure in terms of v per kilopascal (kPa).

2.1.6.3 Multiply the result by [(E_{max}– E_{min}) / n_{LC}] to obtain the result in units of mass (g, kg, or t) per kPa (as stated by the manufacturer). The result must not exceed v_{min}.

$$C_P(v) = \frac{C_P}{(P_2 - P_1)} \cdot \frac{(E_{max} - E_{min})}{n_{max}} \leq v_{min}$$

[1] This test may not be necessary depending on the design of the load cell.

2.1.7 Humidity effects[2] (CH or no mark)

(C_{Hmin}= Change in terms of v due to Humidity effect on the indication of the minimum test load D_{min})

(C_{Hmax}= Change due to Humidity effect on the indication of the maximum test load D_{max})

Remark: If the minimum or maximum test load used for this test differ from the minimum test load D_{min} or maximum test load D_{max} according to R 60-3, 2.1.2 "Load cell errors E_L" the conversion factor f must be recalculated with the minimum and maximum test loads of this test (see R 60-3, 2.1.2.4).

2.1.7.1 From the test indications recorded in R 60-3, Table 6.10.1, calculate the difference between the initial indications for the minimum test load, D_{min}, before and after the damp heat test and divide the result by conversion factor f to obtain the change, C_{Hmin}, in terms of verification interval v (see R 60-1, 5.6.3.1).

$$C_{Hmin} = [(\text{indication at } D_{min})_{after} - (\text{indication at } D_{min})_{before}]/f$$

C_{Hmin} must not exceed $0.04 \cdot n$.

2.1.7.2 Calculate the average indications $\bar{I}\{D_{max}\}$ and $\bar{I}\{D_{min}\}$ at D_{min} and D_{max} (see R 60-2, 2.10.5) for the required number of test indications, before and after the damp heat test. Subtract $\bar{I}\{D_{max}\}$ from $\bar{I}\{D_{min}\}$ for the tests before and after damp heat test and then calculate the difference between the results. Divide the result by the conversion factor f to obtain the change, C_{Hmax}, in terms of v.

$$C_{Hmax} = \frac{[(\bar{I}\{D_{max}\} - \bar{I}\{D_{min}\})_{after} - (\bar{I}\{D_{max}\} - \bar{I}\{D_{min}\})_{before}]}{f}$$

2.1.7.3 C_{Hmax} must not exceed the MPE (see R 60-1, Table 4 in 5.3.2).

2.1.8 Humidity effects[3] (SH)

Report load test errors at different temperatures and humidity conditions using R 60-3, Forms 6.3, then indicate the results in R 60-3, Table 6.10.2 utilizing the procedure contained within "load cell errors" procedure, R 60-3, 2.1.2, in a manner similar to that used for the preparation of R 60-3, Table 6.5.

2.2 Additional tests for digital load cells

2.2.1 Warm-up time

2.2.1.1 Enter data on R 60-3, Form 6.11 (Warm-up time).

2.2.1.2 Span is the result of subtraction of the indication at the minimum test load, D_{min}, from the indication at the maximum test load, D_{max}.

2.2.1.3 Change is the difference between the span and the initial run span.

[2] This test is not necessary if the load cell is marked NH or SH.

[3] This test is not necessary if the load cell is marked NH or CH or has no humidity marking.

2.2.2 Power voltage variations

2.2.2.1 Enter data on R 60-3, Form 6.12.

2.2.2.2 Perform load tests and record results utilizing R 60-3, Form 6.12.

2.2.2.3 Calculate reference indications in accordance with the "load cell errors" procedure, R 60-3, 2.1.2.

2.2.2.4 Indicate results on R 60-3, Form 6.12.

2.2.3 Short-time power reductions

2.2.3.1 Enter data on R 60-3, Form 6.13.

2.2.3.2 Calculate the difference, which is:

$$\text{difference} = \frac{(\text{indication with disturbance, in units} - \text{indication without disturbance, in units})}{\text{conversion factor}, f}$$

2.2.3.3 Indicate results on R 60-3, Form 6.13.

2.2.4 Bursts (electrical fast transients)

2.2.4.1 Enter data on R 60-3, Forms 6.14.1 and 6.14.2.

2.2.4.2 Calculate the difference, which is:

$$\text{difference} = \frac{(\text{indication with disturbance, in units} - \text{indication without disturbance, in units})}{\text{conversion factor}, f}$$

2.2.4.3 Indicate results on R 60-3, Forms 6.14.1 and 6.14.2.

2.2.5 Surge

2.2.5.1 Enter data on R 60-3, Forms 6.15

2.2.5.2 Calculate the difference, which is:

$$\text{difference} = \frac{(\text{indication with disturbance, in units} - \text{indication without disturbance, in units})}{\text{conversion factor}, f}$$

2.2.5.3 Indicate results on R 60-3, Forms 6.15

2.2.6 Electrostatic discharge

2.2.6.1 Enter data on R 60-3, Forms 6.16.1, 6.16.2 and 6.16.3.

2.2.6.2 Calculate the difference, which is:

$$\text{difference} = \frac{(\text{indication with disturbance, in units} - \text{indication without disturbance, in units})}{\text{conversion factor}, f}$$

2.2.6.3 Indicate results on R 60-3, Forms 6.16.1, 6.16.2.1, and 6.16.2.2.

2.2.6.4 Provide test point information on Form 6.16.3.

2.2.7 Electromagnetic susceptibility

2.2.7.1 Enter data on R 60-3, Form 6.17.1.

2.2.7.2 Calculate the difference, which is:

$$\text{difference} = \frac{(\text{indication with disturbance, in units} - \text{indication without disturbance, in units})}{\text{conversion factor}, f}$$

2.2.7.3 Indicate results on R 60-3, Form 6.17.1.

2.2.7.4 Provide test set-up information on R 60-3, Form 6.17.2.

2.2.8 Immunity to conducted electromagnetic fields

2.2.8.1 Enter data on R 60-3, Form 6.18.

2.2.8.2 Calculate the difference, which is:

$$\text{difference} = \frac{(\text{indication with disturbance, in units} - \text{indication without disturbance, in units})}{\text{conversion factor}, f}$$

2.2.8.3 Indicate results on R 60-3, Form 6.18.

2.2.8.4 Provide test setup information on R 60-3, Form 6.18.

2.2.9 Span stability

2.2.9.1 Enter data on R 60-3, Forms 6.19.1 (3 runs) to 6.19.2 (5 runs).

2.2.9.2 Calculate averages and record on R 60-3, Forms 6.19.1 (3 runs) to 6.19.2 (5 runs).

2.2.9.3 Indicate results on R 60-3, Form 6.19.3

2.3 General notes

2.3.1 Absolute (not relative) time shall be recorded.

2.3.2 The testing laboratory may submit any graphs or plots depicting the test results on the following pages of this report.

Note: For example, Figure 1 below gives a sample plot depicting the combined errors versus applied load.

2.3.3 When reporting values for individual test data, the data should be truncated to two significant digits to the right of the decimal place and reported in load cell verification intervals, *v*.

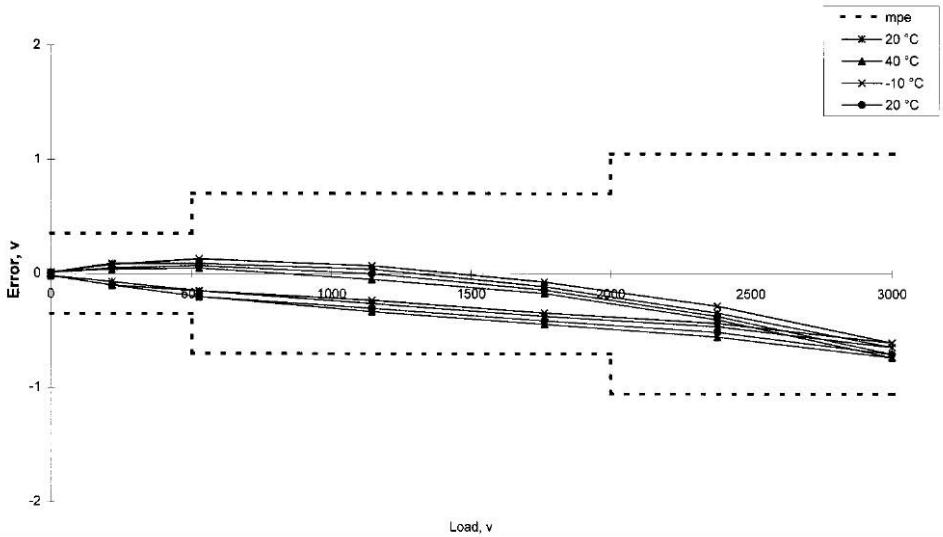

Figure 1 Example of an error envelope

2.4 Formula signs and list of symbols

Symbol	Description	Reference
$C_C(t)$	creep magnitude, expressed in terms of v at time t obtained over the 30 minutes creep test	2.1.5
$C_C(30 – 20)$	difference between output at t = 30 minutes and at t = 20 minutes during creep test	2.1.5.2
C_{DR}	minimum dead load output return, expressed in terms of v	2.1.5
C_{Hmax}	humidity effect on maximum test load output, expressed in terms of v	2.1.7
C_{Hmin}	humidity effect on minimum test load output, expressed in terms of v	2.1.7
C_M	temperature effect on minimum dead load output, expressed in terms of v	2.1.4
$C_M(v_{min})$	temperature effect on minimum dead load output, expressed in terms of v_{min} per 5 °C for class B, C and D or per 2 °C for class A.	2.1.4
C_P	barometric pressure effect, expressed in terms of v	2.1.6
$C_P(v_{min})$	barometric pressure effect, expressed in terms of mass (g, kg, t) per kPa.	2.1.6
D_{max}	maximum test load	R 60-1, 3.5.6
D_{min}	minimum test load	R 60-1, 3.5.12
DR	minimum dead load output return, expressed in mass units (g, kg, t)	R 60-1, 3.5.10
E_L	load cell error, expressed in terms of v	2.1.2
E_{max}	maximum capacity of the load cell	R 60-1, 3.5.5
E_{min}	minimum dead load of the load cell	R 60-1, 3.5.9
E_R	repeatability error, expressed in terms of v	2.1.3
f	conversion factor, number of indicated units per verification interval, v	2.1.2.4
MPE	maximum permissible error	R 60-1, 3.7.10
n	number of load cell verification intervals into which the load cell measuring range is divided	R 60-1 3.5.13
n_{LC}	maximum number of load cell verification intervals	R 60-1, 3.5.8
p_{LC}	apportionment factor	R 60-1, 3.7.2
R_i	reference indication (net test load), expressed in indication units	2.1.2.6
t_0	time t_0 = 0 min when the initial indication at minimum test load is measured	2.1.5
t	time over the 30 minute creep test period after the initial indication (t_0 = 0 min) at minimum test load	2.1.5
T_1, T_2	temperature1, temperature2	2.1.4.2
v	load cell verification interval	R 60-1, 3.5.4
v_{min}	minimum load cell verification interval	R 60-1, 3.5.11

Y	relative v_{min}, $Y = (E_{max} – E_{min}) / v_{min}$	R 60-1, 3.5.15,
Z	relative DR, $Z = (E_{max–} E_{min}) / (2 \times DR)$	R 60-1, 3.5.14

2.5 Summary of formulae contained within calculation procedures

Symbol	Formula
C_C	C_C = (indication – initial indication) / f
C_C(30 – 20)	C_C(30 – 20) = (test indication at 30 minutes – test indication at 20 minutes) / f
C_{DR}	C_{DR} = (minimum test load indication2 – minimum test load indication1) / f
C_{Hmin}	C_{Hmin} = [(indication at $D_{min})_{after}$ – (indication at $D_{min})_{before}$] / f
C_{Hmax}	C_{Hmax} = [(indication at D_{max} – indication at $D_{min})_{after}$ – (indication at D_{max} – indication $D_{min})_{before}$] / f
C_M	C_M = (average test indication at T_2 – average indication at T_1) / f
C_P	C_P = (indication at P_2 – indication at P_1) / f
DR	DR = $E_{max} \times C_{DR} / n_{LC}$
E_L	E_L = (average test indication – reference indication) / f
E_R	E_R = (maximum indication – minimum indication) / f
f	$f = \frac{\text{average indication at } [D_{min} + 0.75 \cdot (D_{max} - D_{min})]}{0.75 \cdot n}$ [see *Note 2*]
R_i	R_i = [(test load – D_{min}) / (D_{max} – D_{min})] × n × f

Note 1: Observe extreme caution by referring to calculation procedure for correct application of these formulae.

Note 2: Use with initial 20 °C ascending load run only. Refer to R 60-2, 2.8.2.

3 Guidance for the application of this Test Report Format

In case a prescribed test is not relevant for the type of instrument to be tested, the reason why the test is omitted shall be clearly stated in the field “Remarks” (for instance surge tests on signal lines shorter than 30 m, tests related to AC mains supply in case of an instrument only powered by batteries, or partial testing after modification of a previously tested type).

The number of the report and the page numbers shall be completed in the heading.

Page 1 of this Report Format may be replaced by a cover page by the Issuing authority.

Enter “NA” or “/” for “the test is not applicable”.

4 The Evaluation Report

Cover page

by the

Issuing Authority

4.1 Authority responsible for this Report

Name	
Address	
Report number	
Application number	
Period of tests	
Date of issuing this Report	
Name and signature of the responsible person	
Stamp(s) (if applicable)	

4.2 Synopsis of the results of the examination and tests

The load cell under test fulfills **ALL** the applicable requirements according to OIML R 60-1	Yes ☐	No ☐
Remarks:		

4.3 Summary of the results of the examination and tests

(To be completed by the Issuing Authority)

4.3.1 Examinations

For details, refer to the tests as indicated in the last column.

General requirements	Passed	Failed	Details in R 60
Documentation			R 60-2, 2.5
Inscription and presentation of load cell information			R 60-1, 6.2

4.3.2 Performance tests (Refer to R 60-2, 2.10

For details, refer to the tests as indicated in the last column.

Tests performed at (20 °C / X_1 °C / X_2 °C / 20 °C):

Test procedure	Passed	Failed	Details in R 60
Maximum permissible measurement errors			R 60-1, 5.3 / R 60-2, 2.10.1
Repeatability error			R 60-1, 5.4 / R 60-2, 2.10.1
Temperature effect on minimum dead load output return			R 60-1, 5.6.1.3 / R 60-2, 2.10.1
Creep test			R 60-1, 5.5.1 / R 60-2, 2.10.2
Minimum dead load output return (DR)			R 60-1, 5.5.2 / R 60-2, 2.10.3
Barometric pressure effects at ambient temperature			R 60-1, 5.6.2 / R 60-2, 2.10.4
Humidity effects (CH, SH)			R 60-1, 5.6.3 / R 60-2, 2.10.5 / 2.10.6

Additional tests performed for digital load cells:

Test procedure	Passed	Failed	Details in R 60
Warm-up time			R 60-1, 5.7.2.1 / R 60-2, 2.10.7.3
Power voltage variations			R 60-1, 5.7.2.2 / 5.7.2.3 / 5.7.2.4 / R 60-2, 2.10.7.4
Short-time power reductions			R 60-1, 5.7.2.5 / R 60-2, 2.10.7.5
Bursts (electronical fast transients)			R 60-1, 5.7.2.5 / R 60-2, 2.10.7.6
Surge			R 60-1, 5.7.2.5 / R 60-2, 2.10.7.7
Electrostatic discharge			R 60-1, 5.7.2.5 / R 60-2, 2.10.7.8
Electromagnetic susceptibility			R 60-1, 5.7.2.5 / R 60-2, 2.10.7.9
Immunity to conducted electromagnetic fields			R 60-1, 5.7.2.5 / R 60-2, 2.10.7.10
Span stability			R 60-1, 5.7.2.6 / R 60-2, 2.10.7.11
Software			R 60-1, 6.1

4.4 General Information regarding the evaluation process

4.4.1 Manufacturer of the specimen

Company	
Address	
Contact information	

4.4.2 Applicant

Company	
Representative (name, telephone)	
Address	
Contact information	
Reference	
Date of application	
Application number	
Applicant authorized by the manufacturer (documented)	☐ Yes ☐ No
Statement that no concurrent application for OIML type evaluation has been made to any other OIML Issuing Authority (see Procedural Document 05 to the OIML-CS, 4.1.2 b)	☐ Yes ☐ No
Remarks:	

4.4.3 Testing laboratories involved in the tests

(This table has to be completed for each test laboratory)

Name			
Address			
Application number			
Tests by this laboratory			
Date/period of tests			
Name(s) of test engineer(s)			
Accredited by		Number:	Expires (date):
Accreditation includes R 60	☐ Yes Edition: ☐		☐ No
Details of relevant peer assessment or assessment by other means			
In case tests have been performed at locations other than the address of this laboratory, give details here			
Name of the responsible person			
Date of signature			
Stamp (if applicable) and signature of the responsible person			
Remarks:			

4.5 General information concerning the load cell type

(as provided by the manufacturer prior to the evaluation)

Manufacturer's name/trade mark	
Manufacturer's type designation (or load cell model number)	

	Unit	**Range**
Accuracy classes		
Maximum number of verification intervals n_{LC}		
Maximum capacity E_{max}	(g, kg, t)	
Minimum capacity E_{min}	(g, kg, t)	
Minimum load cell verification interval $v_{min}=(E_{max} - E_{min}) / Y$	(g, kg, t)	
Minimum dead load output return DR = $(½ \cdot E_{max} / Z)$	(g, kg, t)	
Rated output	(mV/V or counts)	
Input impedance	Ω	

4.6 Accessories, supplied with the test pattern by the applicant

Accessory	Remarks and specifications
Analog data processing device (see OIML R 76 [1], T.2.2.3)	
Cables	
Load cell mounting hardware	
Load introduction elements	
Main power supply	
Battery (type, voltage)	
Indicator (see OIML R 76 [1], T.2.2.2)	
Data printer	
Other accessories:	

Further remarks concerning accessories:

_____

_____

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4.7 Selection of sample(s) tested

4.7.1 Definition of the test pattern (supplied by the applicant for this test report)

This test report is issued for the following load cell:

Model designation	**Serial number**	**Maximum capacity**	**Maximum number of load cell intervals**	**Minimum load cell verification interval**	**Minimum dead load output return**
		E_{max} (g, kg, t)	n_{LC}	v_{min} (g, kg, t)	DR (g, kg, t)

4.7.2 Justification of the selection of the test sample(s)
(refer to R 60-2, 2.3, 2.4 and Annex D):

Model designation	**Serial number**	**Justification / Remark**	**Test Report No.** ***(if available)***

4.8 Adjustments and modifications made to the samples during the testing:

Justification of the selection of the test sample(s) (refer to R 60-2, 2.3):

Model designation	**Serial number**	**Adjustments and modifications made to the samples**	**Test Report No.** ***(if available)***

Further information concerning adjustments:

_____

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4.9 Additional information concerning the type

4.9.1 General information of the load cell under test (specified by the manufacturer)

Manufacturer's name/trade mark		
Manufacturer's type designation (or load cell model number)		
Serial number		
Load cell construction (e.g. S-type, ring type, bending beam)		
Load cell material		
Sealing of strain gauge application (e.g. hermetically, potted)		
Digital load cell (Yes / no)		
Accuracy classes		
Maximum number of verification intervals n_{LC}		
Maximum capacity E_{max}	(g, kg, t)	
Minimum capacity E_{min}	(g, kg, t)	
Minimum load cell verification interval $v_{min} = (E_{max} - E_{min}) / Y$	(g, kg, t)	
Minimum dead load output return DR = $(½ \cdot E_{max} / Z)$	(g, kg, t)	
Rated output	(mV/V or counts)	
Input impedance [1]	Ω	
Cable connection [1]		4-wire / 6-wire
Cable length [2]	m	

1 mandatory for strain gauge load cells

2 mandatory for strain gauge load cells with 4-wire connection

Additional information concerning the type (connection equipment, interfaces, etc.):

_____

_____

_____

_____

_____

_____

4.9.2 Additional information for the performance tests

(Refer to R 60-1, 6.2.2, 6.2.3, and 6.2.4)

Accuracy class	☐ A ☐ B ☐ C ☐ D
Working temperature (if other than –10 °C to +40 °C): Upper_____ °C, Lower_____ °C	
Humidity symbol	☐ NH ☐ SH ☐ CH or no marking
Loading designation: (refer to R 60-1, 6.2.4.2) Tension ☐ Compression ☐ Universal ☐ Beam (shear) ☐ Beam (bending) ☐	
Minimum dead load as: E_{min} =	
Safe load limit as: E_{lim} =	
Excitation voltage: ☐ AC ☐ DC	
Value of the apportionment factor, p_{LC}, if not equal to 0.7	

4.9.3 Additional information of the test pattern for digital load cells

Power voltage: ☐ AC ☐ DC	
Interfaces:	
Output signal:	
Software identification:	
Value of the apportionment factor, p_{LC}, if not equal to 0.7	

4.9.4 Relevant photographs taken during the examinations and tests

4.9.5 Documentation supplied with the test pattern by the applicant

Name of the document	Content	Version-No. / date of issue

4.9.6 Inscriptions and presentations of load cell information

(according to manufacturer statement, refer to R 60-1, 6.2*)*

R 60-1 reference	Information	On the load cell	Accompanying document	In the data sheet
6.2.1 / 6.2.2	Name or trademark of manufacturer			
6.2.1 / 6.2.2	Manufacturer's own designation or load cell model			
6.2.1	Serial number			*Not applicable*
6.2.1	Year of production			*Not applicable*
6.2.1	OIML certificate number			
6.2.2 / 6.2.4.1	Accuracy class(es) and their symbols			
6.2.4.5	Maximum number of load cell verification intervals, n_{LC}			
6.2.2 / 6.2.4.2	Type of load			
6.2.2 / 6.2.4.3	Working temperature designation			
6.2.2 / 6.2.4.4	Humidity symbol “NH”			
6.2.2 / 6.2.4.4	Humidity symbol “SH”			
6.2.2 / 6.2.4.4	No humidity symbol or “CH”			
6.2.2	Minimum dead load, E_{min} [1)]			
6.2.1 / 6.2.2	Maximum capacity, E_{max} [1)]			
6.2.2	Safe load limit, E_{lim} [1)]			
6.2.2	Minimum load cell verification interval (v_{min}) [1)]			
6.2.3, a	Relative v_{min} (Y)			
6.2.3, b	Minimum dead load return DR [1)]			
6.2.3, b	Relative DR (Z)			
6.2.2, l	Rated output			
6.2.2, l	Excitation voltage			
6.2.2, l	Input impedance			
6.2.2, l	Cable connection [2)]			
6.2.2, l	Cable length [3)]			
6.2.2, k	Apportionment factor, p_{LC} (if not equal to 0.7)			
6.2.2, l 6.2.3, c	Further information			

1) In units of (g, kg, t)
2) E.g. 4-wire / 6-wire cable
3) mandatory for strain gauge load cells with 4-wire connection

Further load cell information given by the manufacturer:

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4.9.7 Various designs within the model range:

Model designation	**Maximum capacity**	**Minimum dead load**	**Maximum number of load cell intervals**	**Minimum load cell verification interval**	**Minimum dead load output return**
	E_{max} (g, kg, t)	E_{min} (g, kg, t)	n_{LC}	v_{min} (g, kg, t)	DR (g, kg, t)

4.9.8 Relevant photographs / documentation of the model range:

4.9.9 Definition of load cell families / construction

(This table is to be completed by the manufacturer for each load cell family within the model range)

Type / Model designation	Specification	OIML R 60-1	Remark
	Application of load	3.2.1	*(E.g. tension / compression)*
	Load cell construction	3.3	*(E.g. bending beam)*
	Material or combination of materials	3.4.2	
	Shape	3.4.2	See R 60-2, 6.2.1
	Design of measuring technique	3.3.1	*(E.g. strain gauge bonded to metal)*
	Sealing of strain gauges	3.4.2	
	Mounting method	Annex E	
	Load transmission	Annex E	See R 60-3, 4.9.1
	Output rating	3.4.2	
	Supply voltage	3.4.2	
	Input impedance	3.4.2	
	Cable connection	3.4.2	
	Cable length[1]	3.4.2	

Further remarks concerning the definition of load cell families / construction *(see table above)*

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[1] mandatory for strain gauge load cells with 4-wire connection

4.9.10 Load cell dimensions within the load cell family

Pictures / Drawings of the load cell dimensions of the load cell family

4.9.11 Recommended load transmissions of the manufacturer

Pictures / Drawings of the recommended load transmissions

4.9.12 Results of previous tests that were taken into account

Model designation	Serial number	Justification / Remark	Test Report No. *(if available)*

4.10 Information concerning the test equipment used for the tests

(including details of simulations and the way uncertainties are taken into account, including the level of "risk." For instance, 95 % or $k = 2$)

The following tables have to be completed for each individual piece of test equipment used for the tests.

General information:

For each of the following pieces of test equipment, indicate for which of the following test procedures the test equipment is used:

R 60 reference	Test procedure
R 60-2, 2.10.1	Measurement error, repeatability error and temperature effect on minimum dead load output
R 60-2, 2.10.2	Determination of creep error
R 60-2, 2.10.3	Minimum dead load output return (DR)
R 60-2, 2.10.4	Barometric pressure effects (Atmospheric pressure)
R 60-2, 2.10.5	Humidity effects for load cells marked with CH or no marked
R 60-2, 2.10.6	Humidity effects for load cells marked SH
R 60-2, 2.10.7	Additional tests for digital load cells

Example:
A test equipment is used for determination the measurement error (R 60-2, 2.10.1), the creep error (R 60-2, 2.10.2), the minimum dead load (R 60-2, 2.10.3) and humidity effect marked with SH (R 60-2, 2.10.6):

R 60-2 reference	2.10.1	2.10.2	2.10.3	2.10.4	2.10.5	2.10.5	2.10.6	2.10.7
Used for	X	X	X				X	

4.10.1 Force generating system (if a force generating system or force generating machine is used)

	Description	**Remark**
Designation		
Type		
Manufacturer		
Identification number		
Load range		
Load steps		
Unit		
Preload		
Rel. uncertainty ($k = 2$)		
Last calibration		
Certificate No. / report No.		
Recalibration interval		

The force generating system is used for the following test procedures:

R 60-2 reference	2.10.1	2.10.2	2.10.3	2.10.4	2.10.5	2.10.5	2.10.6	2.10.7
Used for								

Remarks / picture of the force generating system:

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4.10.2 Weights

(if the load cell is tested manually with weights)

Number / identification	Weight (g, kg, t)	Class [1] / rel. uncertainty (k = 2)	Last calibration	Recalibration interval	Certificate No. / report No.

The weights are used for the following test procedures:

R 60-2 reference	2.10.1	2.10.2	2.10.3	2.10.4	2.10.5	2.10.5	2.10.6	2.10.7
Used for								

Remarks / picture of the weights:

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[1] according to OIML R 111

4.10.3 Temperature chamber (without humidity control)

	Description	Remark
Designation		
Type		
Manufacturer		
Identification number		
Height × width × length dimension		
Temperature range		
Temperature stability		
Rel. uncertainty (k = 2)		
Last calibration		
Certificate No. / report No.		
Recalibration interval		

The temperature chamber is used for the following test procedures:

R 60-2 reference	2.10.1	2.10.2	2.10.3	2.10.4	2.10.5	2.10.5	2.10.6	2.10.7
Used for								

Remarks / picture of the temperature chamber:

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4.10.4 Climate chamber (with temperature and humidity control)

	Description	Remark
Designation		
Type		
Manufacturer		
Identification number		
height × width × length dimension		
Temperature range		
Temperature stability		
Humidity range		
Humidity stability		
Rel. uncertainty (k = 2)		
Last calibration		
Certificate No. / report No.		
Recalibration interval		

The climate chamber is used for the following test procedures:

R 60-2 reference	2.10.1	2.10.2	2.10.3	2.10.4	2.10.5	2.10.5	2.10.6	2.10.7
Used for								

Remarks / picture of the climate chamber:

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4.10.5 Indicator / Indicating instrument

(for testing analog load cells)

	Description	Remark
Designation		
Type		
Manufacturer		
Identification / Serial number		
Measurement range		
Rel. uncertainty (k = 2)		
Last calibration		
Certificate No. / report No.		
Recalibration interval		

Settings of the indicator / indicating instrument used for the tests

	Description	Remark
Measurement range		
Supply voltage (AC/DC)		
Filter settings		
Cable connections		

The indicator / indicating instrument is used for the following test procedures:

R 60-2 reference	2.10.1	2.10.2	2.10.3	2.10.4	2.10.5	2.10.5	2.10.6	2.10.7
Used for								

Remarks / picture of the indicator / indicating instrument:

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4.10.6 Terminal / Digital data processing device

(for testing digital load cells)

	Description	Remark
Designation		
Type		
Manufacturer		
Identification / Serial number		
Measurement range		
Last calibration		
Certificate No. / report No.		
Recalibration interval		

Settings of the indicator / indicating instrument used for the tests

	Description	Remark
Measurement range		
Supply voltage (AC/DC)		
Filter settings		
Cable connections		

The terminal / digital data processing device is used for the following test procedures:

R 60-2 reference	2.10.1	2.10.2	2.10.3	2.10.4	2.10.5	2.10.5	2.10.6	2.10.7
Used for								

Remarks / picture of the terminal / digital data processing device:

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4.10.7 Barometric pressure meter

	Description	Remark
Type		
Manufacturer		
Identification / Serial number		
Measurement range		
Rel. uncertainty (k = 2)		
Last calibration		
Certificate No. / report No.		
Recalibration interval		

The barometric pressure meter is used for the following test procedures:

R 60-2 reference	2.10.1	2.10.2	2.10.3	2.10.4	2.10.5	2.10.5	2.10.6	2.10.7
Used for								

4.10.8 Thermometer

	Description	Remark
Type		
Manufacturer		
Identification / Serial number		
Measurement range		
Rel. uncertainty (k = 2)		
Last calibration		
Certificate No. / report No.		
Recalibration interval		

The thermometer is used for the following test procedures:

R 60-2 reference	2.10.1	2.10.2	2.10.3	2.10.4	2.10.5	2.10.5	2.10.6	2.10.7
Used for								

4.10.9 Moisture analyzer

	Description	Remark
Type		
Manufacturer		
Identification / Serial number		
Measurement range		
Rel. uncertainty (k = 2)		
Last calibration		
Certificate No. / report No.		
Recalibration interval		

The moisture analyzer is used for the following test procedures:

R 60-2 reference	2.10.1	2.10.2	2.10.3	2.10.4	2.10.5	2.10.5	2.10.6	2.10.7
Used for								

4.10.10 Additional test equipment

(e.g. burst generator for testing of digital load cells)

	Description	Remark
Test equipment		
Type		
Manufacturer		
Identification / Serial number		
Measurement range		
Rel. uncertainty (k = 2)		
Last calibration		
Certificate No. / report No.		
Recalibration interval		

The equipment is used for the following test procedures:

R 60-2 reference	2.10.1	2.10.2	2.10.3	2.10.4	2.10.5	2.10.5	2.10.6	2.10.7
Used for								

4.10.11 Remarks (settings, pictures, further information)

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5 Examination

(To be completed by the Evaluating Authority)

5.1 Marking requirements (R 60-1, 6.2)

5.1.1 Mandatory markings on the load cell (R 60-1, 6.2.1)

R 60-1 reference	Information	Fulfills requirements	
		Yes	No
6.2.1	Name or trademark of manufacturer		
6.2.1	Manufacturer's own designation or load cell model		
6.2.1	Serial number		
6.2.1	Maximum capacity, E_{max} [1)]		
6.2.1	Year of production		
6.2.1	Type evaluation mark according to R 60-2		

[1)] In units of (g, kg, t)

5.1.2 Mandatory markings on the load cell or an accompanying document

(R 60-1, 6.2.2)

R 60-1 reference	Mandatory information	On load cell	In document	Fulfills requirements	
				Yes	No
6.2.4.1	Accuracy classes and their symbols				
6.2.4.5	Maximum number of load cell verification intervals, n_{LC}				
6.2.4.2	Loading designation (if necessary)				
6.2.4.3	Working temperature designation				
6.2.4.4	Humidity symbol “NH”				
6.2.4.4	Humidity symbol “SH”				
6.2.2	Minimum dead load, E_{min}				
6.2.2	Safe load limit, E_{lim}				
5.1.3, 6.2.2	Minimum load cell verification interval (v_{min})				
6.2.2	Other pertinent conditions				
3.7.2, 5.3.2	Apportionment factor, p_{LC} (if not equal to 0.7)				
5.1.6	Standard classification				
5.1.7	Multiple classifications				

5.1.3 Non-mandatory, additional information (R 60-1, 6.2.3)

R 60-1 reference	Non-mandatory additional information	On load cell	In document	Fulfills requirements	
				Yes	No
5.6.3.1	Humidity symbol “CH”				
3.5.15	Relative v_{min}, Y				
3.5.14	Relative DR, Z				

5.2 Suitability for testing (R 60-2, 2.3, 2.4)

Date:	Observer:	Serial number:

		Fulfils requirements	
		Yes	No
Remarks			
Passed ☐ Yes ☐ No			

5.3 Software (if present) (R 60-1, 6.1)

Date:	Observer:	Serial number:
Version of software:	Identification code:	

	Yes	No
Software protected by sealing		
Automatic change of identification code		
Fixed version number		
Remarks:		
Passed ☐ Yes ☐ No		

5.4 Documentation for type approval (R 60-2, 2.5)

	Yes	No	Remarks
a) Description of the general principle of measurement (R 60-2, 2.5, a)			
b) List and characteristics of essential components + details			
c) Mechanical drawings (R 60-2, 2.5, b)			
d) Electric/electronic diagrams (R 60-2, 2.5, c)			
e) Installation requirements (R 60-2, 2.5, d)			
f) Sealing plan			
g) Panel layout			
h) General information of the software (R 60-2, 2.5, g)			For details, see R 60-1, 6.1
i) Operating instructions (R 60-2, 2.5, e)			
j) Information supporting the manufacturer's assumption of compliance (R 60-2, 2.5, f)			

Other relevant information pertaining to identification of the instrument, diagrams, results of previous tests, etc.: (attach photograph(s) and/or outline-drawing(s) here if available):

Remarks:

Passed	☐ Yes	☐ No

6 Performance tests

6.1 Results of the performance tests

Clause R 60-1/2	Performance tests	Temperature in °C	report page No.	Maximum error in *v*	Passed	Failed	remark
R 60-1, 5.3 / R 60-2, 2.10.1	Load cell errors (E_L) (see R 60-3, 2.1.2)						
R 60-1, 5.4 / R 60-2, 2.10.1	Repeatability errors (E_R) (see R 60-3, 2.1.3)						
R 60-1, 5.5.1 / R 60-2, 2.10.2	Creep ($C_C(t)$) (see R 60-3, 2.1.5)						
R 60-1, 5.5.1 / R 60-2, 2.10.2	Creep (C_C(30–20)) (see R 60-3, 2.1.5.2)						

Clause R 60-1/2	Performance tests	Temperature in °C	report page No.	Maximum error in v	Passed	Failed	Remark
R 60-1, 5.5.2 / R 60-2, 2.10.3	Minimum dead load output return (C_{DR}) / (see R 60-3, 2.1.5.4)						*(See note 1)* DR=
							(See note 1) DR=
							(See note 1) DR=
							(See note 1) DR=
R 60-1, 5.6.3.1 / R 60-2, 2.10.5	Humidity effects (CH_{min}) / (CH or no mark) (see R 60-3, 2.1.7.1)						
R 60-1, 5.6.3.1 / R 60-2, 2.10.5	Humidity effects (CH_{max}) / (CH or no mark) (see R 60-3, 2.1.7)						
R 60-1, 5.6.3.2 R 60-2, 2.10.6	Humidity effects (SH) / (see R 60-3, 2.1.8)						
R 60-1, 5.6.1.3 R 60-2, 2.10.1	Temperature effects on minimum dead load output (C_M) / (see R 60-3, 2.1.4)			*(See note 2)*			
R 60-1, 5.6.2 R 60-2, 2.10.4	Barometric pressure effects ($C_P(v_{min})$) / (see R 60-3, 2.1.6)			*(See note 2)*			

1) DR is the minimum dead load output return in units of (g, kg, t) and determined according to R 60-3, 2.1.5.8
2) Maximum error in unit v_{min}

Remarks:

6.1.1 Results of the Performance tests for digital load cells

Clause R 60-1/2	Performance tests	Temperature in °C	report page No.	Maximum error in *v*	Passed	Failed	remark
R 60-1, 5.7.2.1 / R 60-2, 2.10.7.3	Warm-up time / (see R 60-3, 2.2.1)						
R 60-1, 5.7.2 / R 60-2, 2.10.7.4	Power voltage variations / (see R 60-3, 2.2.2)						
R 60-1, 5.7.2.5 / R 60-2, 2.10.7.5	Short time power reductions / (see R 60-3, 2.2.3)						
R 60-1, 5.7.2.5 / R 60-2, 2.10.7.6	Bursts (electrical fast transients) (see R 60-3, 2.2.4)						
R 60-1, 5.7.2.5 / R 60-2, 2.10.7.7	Surge / (see R 60-3, 2.2.5)						
R 60-1, 5.7.2.5 / R 60-2, 2.10.7.8	Electrostatic discharge / (see R 60-3, 2.2.6)						
R 60-1, 5.7.2.5 / R 60-2, 2.10.7.9	Electromagnetic susceptibility / (see R 60-3, 2.2.7)						
R 60-1, 5.7.2.5 / R 60-2, 2.10.7.10	Immunity to conducted electromagnetic fields / (see R 60-3, 2.2.8)						
R 60-1, 5.7.2.6 / R 60-2, 2.10.7.11	Span stability / (see R 60-3, 2.2.9)						

Remarks:

6.2 Initial tests and general notes concerning performance tests

(To be completed or under the responsibility of the Evaluating Authority)

6.2.1 Units

Unit (e.g. counts, digits, g, kg, t) in which the measurement result is displayed.

R 60-2 reference	Test procedure	Unit
2.10.1	Measurement error, repeatability error and temperature effect on minimum dead load output	
2.10.2	Determination of creep error	
2.10.3	Minimum dead load output return (DR)	
2.10.4	Barometric pressure effects (Atmospheric pressure)	
2.10.5	Humidity effects for load cells marked with CH or no marked	
2.10.6	Humidity effects for load cells marked SH	
2.10.7	Additional tests for analog-active cells	

6.2.2 Measurement range (R 60-1, 5.2, 5.5.2)

				Fulfills requirements	
Test procedure (R 60-2 reference)	D_{max}	D_{min}	**Conversion factor *f* [indication / *v*] (see R 60-3, 2.1.2.4)**	**yes**	**no**
2.10.1					
2.10.2					
2.10.3					
2.10.4					
2.10.5					
2.10.6					
2.10.7					

Passed	☐Yes	☐No

6.2.3 Conditions

(see R 60-2, 2.8.1)

(To ensure that these requirements are met, the calculations should be carried out using lower n values than the n_{LC} specified. The calculations made do not include the application of 2.8.1).

Check that

$$v_{min} \leq \frac{D_{max} - D_{min}}{n}.$$

It should be sufficient to carry out the calculations with $n = n_{LC}$, $n_{max} - 500$ and $n = n_{LC} - 1\,000$ if applicable.

Test procedure (R 60-2 reference)	D_{min}	D_{max}	n_{LC}	Is the requirement $v_{min} \leq \frac{D_{max} - D_{min}}{n}$ fulfilled with					
				n_{LC}		n_{LC} -500		n_{LC}-1000	
				Yes	No	Yes	No	Yes	No
2.10.1									
2.10.2									
2.10.3									
2.10.4									
2.10.5									
2.10.6									
2.10.7									

Passed ☐Yes ☐No

6.2.4 Input impedance

Measure the input impedance and compare the result with the input impedance in OIML R 60-3, 4.5

Input impedance		Fulfills the requirements	
Manufacturer specification According to R 60-3, 4.5	Measured value	yes	no

6.3 Load test data (Load cell error E_L) 3 runs

Ref.: R 60-2, 2.10.1.1 to 2.10.1.11. Complete one sheet for each test temperature, one for each humidity (SH) test in 2.10.6, and when applicable, one for each electronics power voltage in 2.10.7.4.

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____
n_{LC}: _____
v_{min}: _____
p_{LC}: _____ DR: _____
Force-generating system: _____
Indicating instrument: _____
Evaluator: _____

	At start	At end	
Date:			
Temperature:			°C
Relative humidity:			%
Barometric pressure:			kPa
Indicator temperature:			°C

Electronics power voltage
(when applicable): _____V

Table 6.3 (3 runs)

Test load (units)	Run no. 1		Run no. 2		Run no. 3		Average indication (counts)	Repeatability error (counts)
	Indication (counts)	Time (hh mm ss)	Indication (counts)	Time (hh mm ss)	Indication (counts)	Time (hh mm ss)		
0								
0								
0								
0								
0							*	

Notes: 1) * = Average initial minimum test load indication.

2) Absolute (not relative) time shall be recorded.

6.4 Load test data (Load cell error E_L) 5 runs

R 60-2, 2.10.1.1 to 2.10.1.11. Complete one sheet for each test temperature, one for each humidity (SH) test in 2.10.6, and when applicable, one for each electronics power voltage in 2.10.7.4.

Application no.:

Load cell model: _____

Serial no.: _____

E_{max}: _____

n_{LC}: _____

p_{LC}: _____ DR: _____

Evaluator: _____

Force-generating system: _____

Indicating instrument: _____

	At start	At end	
Date:			
Temperature:			°C
Relative humidity:			%
Barometric pressure:			kPa
Indicator temperature:			°C

Electronics power voltage (when applicable): _____V

Table 6.4 (5 runs)

Test load (units)	Run no. 1		Run no. 2		Run no. 3		Run no. 4		Run no. 5		Average indication (counts)	Repeatability error (counts)
	Indication (counts)	Time hh:mm:ss	Indication (counts)	Time hh:mm:ss	Indication (counts)	Time hh:mm:ss	Indication (counts)	Time hh:mm:ss	Indication (counts)	Time hh:mm:ss		
0												
0												
0												
0												
0											*	

Notes: 1) * = Average initial minimum test load indication.
2) Absolute (not relative) time shall be recorded.

6.5 Load cell errors (E_L) calculation

R 60-1, 5.3.1
R 60-2, 2.10.1.12 to 2.10.1.14
R 60-3, 2.1.2.2

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____
n_{LC}: _____
v_{min}: _____
p_{LC}: _____ DR: _____
Force-generating system: _____
Indicating instrument: _____
Evaluator: _____

	At start	At end	
Date:			
Temperature:			°C
Relative humidity:			%
Barometric pressure:			kPa
Indicator temperature:			°C

Conversion factor, f: _____
75 % test load (g, kg, t): _____
Reference indication at 75 % test load: _____

Table 6.5

Test load (units)	Reference indication (counts)	. . . . °C (20 °C)		. . . . °C (T_1 °C)		. . . . °C (T_2 °C)		. . . . °C (20 °C)		MPE (v)
		Indication (counts)	Error (E_L) (v)	Indication (counts)	Error (E_L) (v)	Indication (counts)	Error (E_L) (v)	Indication (counts)	Error (E_L) (v)	
0	0	0		0		0		0		

Minimum test load, D_{min}: _____ PASS: ☐ FAIL: ☐

Notes:
1) Load/reference indications: if a 75 % load point was not obtained, a straight line interpolation between the adjacent higher and lower load point indications is used (see R 60-1, 5.3.1 and calculation procedures in R 60-3, 2.1.2.2).
2) Error, E_L: the difference between the test indication and the reference indication divided by the conversion factor, f.
3) Test load values are values above minimum test load, D_{min}.

6.6 Repeatability errors (E_R) calculation

R 60-1, 5.4
R 60-2, 2.10.1.15
R 60-3, 2.1.3

Application no.: _____
Load cell model: _____ ___
Serial no.: _____
E_{max}: _____
n_{LC}: _____
v_{min}: _____
p_{LC}: _____DR: _____

Force-generating system: _____
Indicating instrument: _____
Evaluator: _____
Conversion factor, f: _____

Table 6.6

Test load (unit)	. . . . °C (20 °C)		. . . . °C (T_1 °C)		. . . . °C (T_2 °C)		. . . . °C (20 °C)		MPE (v)
	Repeatability error (counts)	Repeatability error (v)	Repeatability error (counts)	Repeatability error (v)	Repeatability error (counts)	Repeatability error (v)	Repeatability error (counts)	Repeatability error (v)	

PASS: ☐ FAIL: ☐

Note: Error, E_R: the maximum difference between the three test indications divided by the conversion factor, f (classes C and D) or the maximum difference between the five test indications divided by the conversion factor, f (classes A and B).

6.7 Temperature effects on minimum dead load output return (MDLO)

R 60-1, 5.5.2
R 60-2, 2.10.1.16
R 60-3, 2.1.4

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____
n_{LC}: _____
v_{min}: _____
p_{LC}: _____ DR:_____

Force-generating system: _____
Indicating instrument: _____
Evaluator: _____

Conversion factor, f:_____

Table 6.7

Temperature °C	Indication ( )	Change (C_M) (v)	Change (v_{min} / . . . . °C)	mpc (v_{min} / . . . . °C)
				p_{LC}
				p_{LC}
				p_{LC}

PASS: ☐ FAIL: ☐

Notes:
1) MDLO: minimum dead load output.
2) Indication: the average initial minimum test load indication obtained from Table D.1.
3) The maximum permissible change (mpc) allowed is: (v_{min} / 5 °C) for classes B, C, and D; (v_{min} / 2 °C) for class A.
4) Change, C_M (v): the difference between the observed indications, and the indications at the prior temperature, divided by the conversion factor, f.

6.8 Creep (C_C) and DR (C_{DR})

R 60-1, 5.5.1, 5.5.2
R 60-2, 2.10.2, 2.10.3. Complete one sheet for each test temperature.

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____
n_{LC}: _____
v_{min}: _____
p_{LC}: _____ DR:_____
Force-generating system: _____
Indicating instrument: _____
Evaluator: _____

	At start	At end	
Date:			
Temperature:			°C
Relative humidity:			%
Barometric pressure:			kPa
Indicator temperature:			°C

Conversion factor, f: _____

Table 6.8

Creep							**DR**						
Test load	Original		Barom. Press	Change of		mpc	Test load	Original		Barom. Press.	Change of		mpc
	Indication	Time		Indication	Time			Indication	Time		Indication	Time	
	counts	hh:mm:ss	kPa	*v*	mm:ss	*v*		counts	hh:mm:ss	kPa	*v*	mm:ss	*v*
D_{min}													
D_{max}													
(*)							D_{max}						
D_{min}													
							(***)						
D_{max}							D_{min}						
(**)													

DR (*v*):		30 minute creep:	PASS: ☐	FAIL: ☐
actual time (s):		20 – 30 minute creep difference (< 0.15*MPE):	PASS: ☐	FAIL: ☐
specified time (s):		DR < 0.5 *v*:	PASS: ☐	FAIL: ☐
MPE for DR (*v*):		DR within manuf. Specified DR requirements:	PASS: ☐	FAIL: ☐

Notes: 1) Change (*v*) for creep: the observed indication minus the initial "load" indication (**) divided by the conversion factor, *f*.
2) Determine the difference between the reading obtained at 20 minutes and the reading obtained at 30 minutes (see 5.5.1).
3) Change (*v*) for DR: the initial indication (***) minus the initial "no load" indication (*) divided by the conversion factor, *f*.
4) Absolute (not relative) time shall be recorded.

6.9 Barometric pressure effects (C_P)

R 60-1, 5.6.2
R 60-2, 2.7.3.8, 2.10.4
R 60-3, 2.1.6

Complete one sheet for each test temperature.

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____ E_{min}: _____
n_{LC}: _____ p_{LC}: _____
Y: _____ Z: _____
v_{min}: _____ DR: _____
Force-generating system: _____
Test load, D_{max}: _____ D_{min}: _____
Indicating instrument: _____
Evaluator: _____

	At start	At end	
Date:			
Temperature:			°C
Relative humidity:			%
Barometric pressure:			kPa
Indicator temperature:			°C

Conversion factor, f: _____

Table 6.9

Pressure (kPa)	Indication (counts)	Time hh:mm	Change (v)	Change (v_{min} / kPa)	mpc (v_{min} / kPa)
			0	0	0
					1
					1
					1

PASS: ☐ FAIL: ☐

6.10 Humidity effects

6.10.1 Humidity effects (CH or no mark)

R 60-1, 5.6.3
R 60-2, 2.7.3.9, 2.10.5
R 60-3, 2.1.7

Form 6.10.1.(a): Humidity effects summary (CH or no mark)

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____ E_{min}: _____
n_{LC}: _____ p_{LC}: _____
Y: _____ Z: _____
v_{min}: _____ DR: _____
Force-generating system: _____
Test load, D_{max}: _____ D_{min}: _____
Indicating instrument: _____
Evaluator: _____

	At start	At end	
Date:			
Temperature:			°C
Relative humidity:			%
Barometric pressure:			kPa
Indicator temperature:			°C

Conversion factor, f: _____

Table 6.10.1.(a)

Test load (g, kg, or t)	Before humidity test		After humidity test		Change (v)	mpc (v)
	Indication (counts)	Time (hh mm ss)	Indication (counts)	Time (hh mm ss)		
Average indication at D_{min} (¤)				C_{Hmin} =		
Average indication at D_{max} (‡)						
Average difference (*)				C_{Hmax} =		1

← < 4 % n_{LC}

(¤) Indications at minimum test load Change (¤), C_{Hmin}:PASS: ☐ FAIL: ☐

(‡) Indications at maximum test load *(see note 3)*

(*) Average, see R 60-1, 5.6.3 and R 60-3, 2.1.7 Change (*), C_{Hmax}:PASS: ☐ FAIL: ☐

Notes:
1) This test is not necessary if the load cell is marked NH or SH.
2) Change (v): the difference between the indication after and before humidity exposure divided by the conversion factor, f.
3) Use five test runs for Class A and B; use 3 test runs for Class C and D.
4) Absolute (not relative) time shall be recorded.
5) For family certification this test is not necessary, if a pattern with a smaller capacity and the same or better metrological characteristics has passed this test.

Form 6.10.1.(b): Load test data (E_L) - 3 runs

R 60-2, 2.10.1.1–2.10.1.11. Complete this form if the measurement error is determined **before** the humidity test (CH) is carried out (not mandatory)

Application no.: _____

Load cell model: _____

Serial no.: _____

E_{max}: _____ E_{min}: _____

n_{LC}: _____ p_{LC}: _____

Y: _____ Z: _____

v_{min}: _____ DR: _____

Force-generating system: _____

Test load, D_{max}: _____ D_{min}: _____

Indicating instrument: _____

Evaluator: _____

	At start	At end	
Date:			
Temperature:			°C
Relative humidity:			%
Barometric pressure:			kPa
Indicator temperature:			°C

Electronics power voltage

(when applicable): _____

Table 6.10.1. (b) (3 runs)

Test load (unit)	Run no. 1		Run no. 2		Run no. 3		Average indication counts	Repeatability error counts
	Indication counts	Time hh:mm:ss	Indication Counts	Time hh:mm:ss	Indication counts	Time hh:mm:ss		
							*	

Notes: * Average initial minimum test load indication
Absolute (not relative) time shall be recorded

Form 6.10.1.(c): Load test data (E_L) - 3 runs

R 60-2, 2.10.1.1–2.10.1.11. Complete this form if the measurement error is determined **after** the humidity test (CH) is carried out (not mandatory)

Application no.: _____

Load cell model: _____

Serial no.: _____

E_{max}: _____ E_{min}: _____

n_{LC}: _____ p_{LC}: _____

Y: _____ Z: _____

v_{min}: _____ DR: _____

Force-generating system: _____

Test load, D_{max}: _____ D_{min}: _____

Indicating instrument: _____

Evaluator: _____

	At start	At end	
Date:			
Temperature:			°C
Relative humidity:			%
Barometric pressure:			kPa
Indicator temperature:			°C

Electronics power voltage

(when applicable): _____

Table 6.10.1. (c) (3 runs)

Test load (unit)	Run no. 1		Run no. 2		Run no. 3		Average indication counts	Repeatability error counts
	Indication counts	Time hh:mm:ss	Indication counts	Time hh:mm:ss	Indication counts	Time hh:mm:ss		
							*	

Notes: * Average initial minimum test load indication
Absolute (not relative) time shall be recorded

Form 6.10.1.(d): Load test data (E_L) - 5 runs

R 60-2, 2.10.1.1–2.10.1.11. Complete this form if the measurement error is determined **before** the humidity test (CH) is carried out (not mandatory)

Application no.: _____

Load cell model: _____

Serial no.: _____

E_{max}: _____ E_{min}: _____

n_{LC}: _____ p_{LC}: _____

Y: _____ Z: _____

v_{min}: _____ DR: _____

Force-generating system: _____

Test load, __D_{max}: _____ D_{min}: _____

Indicating instrument: _____

Evaluator: _____

	At start	At end	
Date:			
Temperature:			°C
Relative humidity:			%
Barometric pressure:			kPa
Indicator temperature:			°C

Electronics power voltage

(when applicable): _____

Table 6.10.1.(d) 5 runs

Test load (unit)	Run no. 1		Run no. 2		Run no. 3		Run no. 4		Run no. 5		Average indication counts	Repeatability error counts
	Indication counts	Time hh:mm:ss	Indication counts	Time hh:mm:ss	Indication counts	Time hh:mm:ss	Indication counts	Time hh:mm:ss	Indication counts	Time hh:mm:ss		
*												

Note: *Average initial minimum test load indication

Form 6.10.1.(e): Load test data (E_L) - 5 runs

R 60-2, 2.10.1.1–2.10.1.11. Complete this form if the measurement error is determined **after** the humidity test (CH) is carried out (not mandatory)

Application no.: _____

Load cell model: _____

Serial no.: _____

E_{max}: _____ E_{min}: _____

n_{LC}: _____ p_{LC}: _____

Y: _____ Z: _____

v_{min}: _____ DR: _____

Force-generating system: _____

Test load, _D_{max}: _____ D_{min}: _____

Indicating instrument: _____

Evaluator: _____

	At start	At end	
Date:			
Temperature:			°C
Relative humidity:			%
Barometric pressure:			kPa
Indicator temperature:			°C

Electronics power voltage

(when applicable): _____

Table 6.10.1.(e) 5 runs

Test load (unit)	Run no. 1		Run no. 2		Run no. 3		Run no. 4		Run no. 5		Average indication counts	Repeatability error counts
	Indication counts	Time hh:mm:ss	Indication counts	Time hh:mm:ss	Indication counts	Time hh:mm:ss	Indication counts	Time hh:mm:ss	Indication counts	Time hh:mm:ss		
*												

Note: *Average initial minimum test load indication

6.10.2 Humidity effects (SH)

Form 6.10.2 Humidity effects (SH) summary

R 60-1, 5.6.3.2
R 60-2, 2.7.3.9, 2.10.6
R 60-3, 2.1.8

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____ E_{min}: _____
n_{LC}: _____ p_{LC}: _____
Y: _____ Z: _____
v_{min}: _____ DR: _____
Force-generating system: _____
Test load, $D_{max:}$ _____ $D_{min:}$ _____
Indicating instrument: _____
Evaluator: _____

	At start	At end	
Date:			
Conditioning period:			
Reference temperature:			
High temperature:			°C
Reference relative humidity:			%
High relative humidity:			%

Conversion factor, f: _____
Page of load test before humidity test: _____
Page of load test during humidity test: _____
Page of load test after humidity test: _____

For summary of SH-humidity load test errors: use form 6.3 (3 runs) or 6.4 (5 runs) as appropriate to record individual teat results.

Table 6.10.2

Test load kg	Reference indication (counts)	…. °C (20 °C) …. % (50 %) RH		…. °C (High) …. % (85 %) RH		…. °C (20 °C) …. % (50 %) RH		MPE v
		Indication (counts)	Error (E_L) v	Indication (counts)	Error (E_L) v	Indication (counts)	Error (E_L) v	

PASS: ☐ FAIL: ☐

Notes:

1) Load/reference indications: if at 75 % load point was not obtained, a straight line interpolation between the adjacent higher and lower load point indication is used.
2) Error, E_L: the difference between the test reference and the reference indication divided by the conversion factor, f.
3) Test load values are values above minimum test load, D_{min}.
4) Conditioning period: the time period for exercising the load cell.
5) For family certification this test is not necessary, if a pattern with a smaller capacity and the same or better metrological characteristics has passed this test.

6.11 Warm-up time

Form 6.11 Warm-up time

R 60-1, 3.5.17
R 60-2, 2.10.7.3
R 60-3, 2.2.1

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____ E_{min}: _____
n_{LC}: _____ p_{LC}: _____
Y: _____ Z: _____
Force-generating system: _____
Test load, D_{max}: _____ D_{min}: _____
Indicating instrument: _____
Evaluator: _____

	At start	At end	
Date:			
Time:			
Temperature:			°C
Relative humidity:			%
Barometric pressure:			kPa

Conversion factor, f: _____ counts/v

Duration of disconnection before test: _____

Table 6.11

Test load (units)	Preloads	
	Indication (counts)	Time hh:mm:ss
D_{min}		
D_{max}		
D_{min}		
D_{max}		
D_{min}		
D_{max}		

		Initial run		After 5 min.		After 15 min.		After 30 min.		mpc
		Indication (counts)	Time hh:mm:ss	Indication (counts)	Time hh:mm:ss	Indication (counts)	Time hh:mm:ss	Indication (counts)	Time hh:mm:ss	v_{min}
	D_{min}									
	D_{max}									
Span	Counts									
Span	v_{min}									
Change	v_{min}									

PASS: ☐ FAIL: ☐

Notes:

1) Absolute (not relative) time shall be recorded.
2) Span: the result of subtraction of the indication at minimum test load from the indication at maximum test load. All span errors (error at maximum test load minus the error at minimum test load) shall be within the maximum permissible error during the 30 minute test.
3) The change of span must not exceed v_{min}.
4) Change: the difference between the span and the initial run span.
5) Maximum permissible change, mpc: the absolute value of the maximum permissible error for the maximum test load applied.
6) Exercises have to be run before disconnection.

6.12 Power voltage variation

Form 6.12 Power voltage variation

R 60-1, 5.7.2.2, 5.7.2.3, 5.7.2.4
R 60-2, 2.10.7.4
R 60-3, 2.2.2

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____ E_{min}: _____
n_{LC}: _____ p_{LC}: _____
Y: _____ Z: _____
Force-generating system: _____
Test load, D_{max}: _____ D_{min}: _____
Indicating instrument: _____
Evaluator: _____

	At start	At end	
Date:			
Time:			
Temperature:			°C
Relative humidity:			%
Barometric pressure:			kPa

Conversion factor, f: _____ counts/v

Main voltage: _____

AC: ☐ DC: ☐

Table 6.12 (a)

Test load (units)	Preloads	
	Indication (counts)	Time hh:mm:ss
D_{min}		
D_{max}		
D_{min}		
D_{max}		
D_{min}		
D_{max}		

Notes:
1) Reference indications: if at 75 % load point was not obtained, a straight line interpolation between the adjacent higher and lower indication is used (see 2.8.2 in R 60-2 and calculation procedures in R 60-3, 2.1.2)
2) Error: the difference between the test indication and the reference indication divided by the conversion factor, f.
3) The change of span must not exceed v_{min}.
4) When a voltage range is marked, use the average value as the reference value and determine upper and lower values of applied voltage according to R 60-2, 2.10.7.4.
5) Upper limit not applicable to battery powered load cells
6) At lower limit, battery powered load cells shall function and be within MPE, or cease to function

		Initial run with main voltage		lower limit main voltage – 15 %		upper limit +10 %		mpc v_{min}
		Indication (counts)	Time hh:mm:ss	Indication (counts)	Time hh:mm:ss	Indication (counts)	Time hh:mm:ss	
	D_{min}							
	D_{max}							
Span	Counts							
Span	v_{min}							
Change	v_{min}							

PASS: ☐ FAIL: ☐

If AC power supply is used (not applicable for battery power supply)

Table 6.12 (b)

		Initial run with main voltage		lower limit frequency – 2 %		upper limit frequency + 2 %		mpc v_{min}
		Indication (counts)	Time hh:mm:ss	Indication (counts)	Time hh:mm:ss	Indication (counts)	Time hh:mm:ss	
	D_{min}							
	D_{max}							
Span	Counts							
Span	v_{min}							
Change	v_{min}							

PASS: ☐ FAIL: ☐

6.13 Short time power reductions

Form 6.13 Short time power reductions

R 60-1, 5.7.2.5
R 60-2, 2.10.7.5
R 60-3, 2.2.3

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____
n_{LC}: _____
v_{min}: _____
p_{LC}: _____
DR: _____
Force-generating system: _____
Indicating instrument: _____
Evaluator: _____

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Conversion factor, *f*: _____
Minimum test load, D_{min}: _____
Reference voltage range: _____ V

Table 6.13

Test load (g, kg, t)	Disturbance				Result			
	Amplitude (%)	Duration (cycles)	Number of disturbances	Repetition interval (v)	Indication ( )	Difference (v)	Significant fault > v_{min}	
							No	Yes (remarks)
Without disturbance								
	0	0.5	10					
	50	1	10					

Equipment used (supply sketch if necessary): PASS: ☐ FAIL: ☐

Remarks:

Note: In the case of a voltage range, use the average value as the reference value.

6.14 Bursts (electrical fast transients)

Form 6.14.1 Bursts (electrical fast transients) – power supply lines

R 60-1, 5.7.2.5
R 60-2, 2.10.7.6
R 60-3, 2.2.4

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____
n_{LC}: _____
v_{min}: _____
p_{LC}: _____DR: _____
Force-generating system: __ _____
Indicating instrument: _____
Evaluator: _____

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Conversion factor, *f*: _____
Minimum test load, D_{min}: _____

Table 6.14.1

Power supply lines: test voltage = 2 kV; duration of test = 1 minute at each polarity

Test load (g, kg, or t)	Connection			Polarity	Result			
	L to ground	N to ground	PE to ground		Indication ( )	Difference (v)	Significant fault > v_{min}	
							No	Yes (remarks)
	without disturbance							
	×			pos				
				neg				
	without disturbance							
		×		pos				
				neg				
	without disturbance							
			×	pos				
				neg				

L = phase, N = neutral, PE = protective earth PASS: ☐ FAIL: ☐

Equipment used (supply sketch if necessary)

Form 6.14.2 Bursts (electrical fast transients) – I/O circuits and communications lines

R 60-1, 5.7.2.5
R 60-2, 2.10.7.6
R 60-3, 2.2.4

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____
n_{LC}: _____
v_{min}: _____
p_{LC}: _____DR: _____
Force-generating system: __ _____
Indicating instrument: _____
Evaluator: _____

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Conversion factor, f: _____

Minimum test load, D_{min}: _____

Table 6.14.2

Test load (g, kg, or t)	Cable interface	Polarity	Result			
			Indication ( )	Difference (v)	Significant fault > v_{min}	
					No	Yes (remarks)
	without disturbance					
		pos				
		neg				
	without disturbance					
		pos				
		neg				
	without disturbance					
		pos				
		neg				
	without disturbance					
		pos				
		neg				
	without disturbance					
		pos				
		neg				
	without disturbance					
		pos				
		neg				

Equipment used (supply sketch if necessary) PASS: ☐ FAIL: ☐

Remarks:

Note: Explain or make a sketch indicating where the clamp is located on the cable: if necessary use additional page(s).

6.15 Surges

Form 6.15 Surges

R 60-1, 5.7.2.5
R 60-2, 2.10.7.7
R 60-3, 2.2.5

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____
n_{LC}: _____
v_{min}: _____
p_{LC}: _____DR: _____
Force-generating system: __ _____
Indicating instrument: _____
Evaluator: _____

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Conversion factor, f: _____

Minimum test load, D_{min}: _____

Table 6.15

OIML R 60-2, ...	Test conditions surges on signal, data and control lines				Observer's name:	
	Output gained	☐	using actual loads			
			Test load:		Line to line	1 kV
		☐	simulating loading		Line to earth	2 kV
			using:			
	Cable:				☐ Symmetrical line	
[unit]	Date:		Start	Stop	☐ Unsymmetrical line	
☐[g];	Time:				Specimen:	
☐[kg];	Ambient temperature		ºC	ºC	f	
☐[t]	Relative humidity		%	%	D_{min}	[unit]
	Barometric Pressure		kPa	kPa	D_{max}	[unit]

	Cycle phase	**Initial**	**During exposure**	**After**
	Load			
Time	Start			
	Stop			
Quantity [unit]	reference			
	indicated			
Error [v_{min}]				
relative error [%] E_{ii}				
MPE [%]				
	Pass	☐		☐
	Fail	☐		☐

Observed faults after exposure						
Fault limit [%]		.....				
Line to line (N/A for balanced)		Fault/Deviation	Significant		Acts on fault	
↑■	↓■		Yes	No	Yes	No
3x			☐	☐	☐	☐
	3x		☐	☐	☐	☐
Line to earth						
3x			☐	☐	☐	☐
	3x		☐	☐	☐	☐
Observations						
Result			Pass	☐	Fail	☐

6.16 Electrostatic discharge

Form 6.16.1 Electrostatic discharge – direct application

R 60-1, 5.7.2.5
R 60-2, 2.10.7.8
R 60-3, 2.2.6

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____
n_{LC}: _____
v_{min}: _____
p_{LC}: _____DR: _____
Force-generating system: __
Indicating instrument: _____
Evaluator: _____

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Conversion factor, *f:* _____

Minimum test load, D_{min}: _____

☐ Contact discharges
☐ Paint penetration
☐ Air discharges

Polarity (*see Note 2*):
☐ Positive
☐ Negative

Table 6.16.1

Test load (g, kg, t)				Result			
	Test voltage (kV)	No. of discharges ≥ 10	Repetition interval (s)	Indication ( )	Difference (v)	Significant fault > v_{min}	
						No	Yes (remarks)
	without disturbance						
	2						
	4						
	8 (air discharges)						

PASS: ☐ FAIL: ☐

Remarks:

Notes: 1) If the load cell fails, the test point at which this occurs shall be recorded.
2) IEC Publication 61000-4-2 (2008) Ed 1.1 Consolidated edition specifies that the test be conducted with the most sensitive polarity.

Form 6.16.2 Electrostatic discharge – indirect application

R 60-1, 5.7.2.5
R 60-2, 2.10.7.8
R 60-3, 2.2.6

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____
n_{LC}: _____
v_{min}: _____
p_{LC}: _____DR: _____
Force-generating system: __ _____
Indicating instrument: _____
Evaluator: _____

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Conversion factor, f: _____
Minimum test load, D_{min}: _____

Polarity (*see Note 2*): ☐ Positive ☐ Negative

Table 6.16.2.1 – Horizontal coupling plane

Test load (g, kg, or t)	Test voltage (kV)	No. of discharges ≥ 10	Repetition interval (s)	Result: Indication ( )	Result: Difference (v)	Result: Significant fault > v_{min}: No	Result: Significant fault > v_{min}: Yes (remarks)
	without disturbance						
	2						
	4						
	6						

Table 6.16.2.2 – Vertical coupling plane

Test load (g, kg, or t)	Test voltage (kV)	No. of discharges ≥ 10	Repetition interval (s)	Result: Indication ( )	Result: Difference (v)	Result: Significant fault > v_{min}: No	Result: Significant fault > v_{min}: Yes (remarks)
	without disturbance						
	2						
	4						
	6						

PASS: ☐ FAIL: ☐

Remarks:

Notes: 1) If the load cell fails, the test point at which this occurs shall be recorded.
2) IEC Publication 61000-4-2 (1999-05) Ed 1.1 Consolidated edition specifies that the test be conducted with the most sensitive polarity.

Form 6.16.3 Electronic discharge (continued) – specification of test points

R 60-1, 5.7.2.5
R 60-2, 2.10.7.8
R 60-3, 2.2.6

Specify test points utilized on load cell and test equipment used, e.g. by photos or sketches.

a) Direct application

Contact discharges:

Air discharges:

b) Indirect application

6.17 Electromagnetic susceptibility

Form 6.17.1 Electromagnetic susceptibility

R 60-1,5.7.2.5
R 60-2, 2.10.7.9
R 60-3, 2.2.7

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____
n_{LC}: _____
v_{min}: _____
p_{LC}: _____DR: _____
Force-generating system: _____
Indicating instrument: _____
Evaluator: _____

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Conversion factor, f: _____

Minimum test load, D_{min}: _____

Rate of sweep: [ ]

Test load: [ ] Test load material: [ ]

Table 6.17

Disturbance				Result			
Antenna	Frequency range (MHz)	Polarization	Facing load cell	Indication ( )	Difference (v)	Significant fault > v_{min}	
						No	Yes (remarks)
without disturbance							
		Vertical	Front				
			Right				
			Left				
			Rear				
		Horizontal	Front				
			Right				
			Left				
			Rear				

PASS: ☐ FAIL: ☐

Frequency range: 26–3 000 MH_Z
Field strength: 10 V/m
Modulation: 80 % AM, 1 kHz sine wave

Remarks:

Note: If the load cell fails, the test point at which this occurs shall be recorded.

Form 6.17.2 Electromagnetic susceptibility (continued) – description of the test setup

Describe the setup of the test and equipment, e.g. by photos or sketches:

6.18 Immunity to conducted electromagnetic fields

R 60-1, 5.7.2.5
R 60-2, 2.10.7.10
R 60-3, 2.2.8

Form 6.18 Immunity to conducted electromagnetic fields

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____
n_{LC}: _____
v_{min}: _____
p_{LC}: _____DR: _____
Force-generating system: _____
Indicating instrument: _____
Evaluator: _____

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Conversion factor, *f:* _____

Minimum test load, D_{min}: _____

Rate of sweep: [ ]

Test load: [ ] Test load material: [ ]

Table 6.18

OIML R 60-2, ...	Test conditions RF current injection				Observer's name:	
	Output gained	☐	using actual loads			
			Test load:		f_l =	MHz
		☐	simulating loading		f_h =	MHz
			using:		RF voltage	V_{emf}
	Cable exposed				Modulation	% AM
	Date:		Start	Stop	Dwell time	s
[unit] ☐[g]; ☐[kg]; ☐[t]	Time:				Specimen:	
	Ambient temperature		ºC	ºC	f	
	Relative humidity		%	%	D_{min}	[unit]
	Barometric pressure		kPa	kPa	D_{max}	[unit]

Frequency cycle	Cycle phase	**Initial**	**During exposure**	**After**
	Load			
Time	Start			
	Stop			
Quantity [unit]	reference			
	indicated			
Error [v_{min}]				
relative error [%] E_{ii}				
MPE [%]				
	Pass	☐		☐
	Fail	☐		☐

Observed faults during exposure						
Fault limit [%]		.....				
Frequency		Fault/Deviation	Significant		Acts on fault	
MHz			Yes	No	Yes	No
			☐	☐	☐	☐
			☐	☐	☐	☐
			☐	☐	☐	☐
			☐	☐	☐	☐
			☐	☐	☐	☐
			☐	☐	☐	☐
			☐	☐	☐	☐
			☐	☐	☐	☐
			☐	☐	☐	☐
			☐	☐	☐	☐
			☐	☐	☐	☐
			☐	☐	☐	☐
Observations						
Result			Pass	☐	Fail	☐

6.19 Span stability

Form 6.19.1 (3 runs) Span stability – measurement data for classes C and D

R 60-1, 5.7.2.6
R 60-2, 2.10.7.11
R 60-3, 2.2.9

Application no.: _____ Force-generating system: _____
Load cell model: _____ Indicating instrument: _____
Serial no.: _____ p_{LC}: _____ DR:_____
E_{max}: _____ Conversion factor, f: _____
n_{LC}: _____ Minimum test load, D_{min}: _____
v_{min}: _____ Maximum test load, D_{max}: _____

Notes:

1) Span is the result of subtracting the average indication at minimum test load from the average indication at maximum test load.
2) Absolute (not relative) time shall be recorded.

Table 6.19.1 (3 runs)

Measurement no. 1:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Average indication ( )
	Indication ( )	Time	Indication ( )	Time	Indication ( )	Time	
						span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____ Remarks:

Measurement no. 2:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Average indication ( )
	Indication ( )	Time	Indication ( )	Time	Indication ( )	Time	
						span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____

Remarks:

Measurement no. 3:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Average indication ( )
	Indication ( )	Time	Indication ( )	Time	Indication ( )	Time	
						span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____

Remarks:

Measurement no. 4:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Average indication ( )
	Indication ( )	Time	Indication ( )	Time	Indication ( )	Time	
						span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____

Remarks:

Measurement no. 5:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Average indication ( )
	Indication ( )	Time	Indication ( )	Time	Indication ( )	Time	
						span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____

Remarks:

Measurement no. 6:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Average indication ( )
	Indication ( )	Time	Indication ( )	Time	Indication ( )	Time	
						span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____

Remarks:

Measurement no. 7:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Average indication ( )
	Indication ( )	Time	Indication ( )	Time	Indication ( )	Time	
						span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____

Remarks:

Measurement no. 8:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Average indication ( )
	Indication ( )	Time	Indication ( )	Time	Indication ( )	Time	
						span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____

Remarks:

Form 6.19.2 (5 runs) Span stability measurement data for class B

R 60-1, 5.7.2.6
R 60-2, 2.10.7.11
R 60-3, 2.2.9

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____
n_{LC}: _____
V_{min}: _____

Force-generating system:
Indicating instrument: _____
p_{LC}: _____ DR: _____
Conversion factor, f: _____
Minimum test load, D_{min}: _____
Maximum test load, D_{max}: _____

Notes: 1) Span is the result of subtracting the average indication at minimum test load from the average indication at maximum test load.

2) Absolute (not relative) time shall be recorded.

Table 6.19.2 (5 runs)

Measurement no. 1:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Run no. 4		Run no. 5		Average indication ( )
	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	
										Span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____
Remarks:

Measurement no. 2:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Run no. 4		Run no. 5		Average indication ( )
	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	
										Span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____
Remarks:

Measurement no. 3:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Run no. 4		Run no. 5		Average indication ( )
	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	
										Span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____
Remarks:

Measurement no. 4:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Run no. 4		Run no. 5		Average indication ( )
	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	
										Span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____
Remarks:

Measurement no. 5:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Run no. 4		Run no. 5		Average indication ( )
	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	
										Span	

Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Date: _____

Evaluator: _____
Remarks:

Measurement no. 6:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Run no. 4		Run no. 5		Average indication ( )
	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	
										Span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____
Remarks:

Measurement no. 7:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Run no. 4		Run no. 5		Average indication ( )
	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	
										Span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____
Remarks:

Measurement no. 8:

Test load (g, kg, t)	Run no. 1		Run no. 2		Run no. 3		Run no. 4		Run no. 5		Average indication ( )
	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	indication ( )	Time	
										Span	

Date:		
Time:		
Temperature:		°C
Relative humidity:		%
Barometric pressure:		kPa

Evaluator: _____
Remarks:

Form 6.19.3 Span stability – summary of test results

R 60-1, 5.7.2.6
R 60-2, 2.10.7.11
R 60-3, 2.2.9

Application no.: _____
Load cell model: _____
Serial no.: _____
E_{max}: _____
n_{LC}: _____
v_{min}: _____
p_{LC}: _____DR: _____
Force-generating system: _____
Indicating instrument: _____
Evaluator: _____

Table 6.19.3

Measurement no. (see Note 3)	Span		Variation (v_{min})	Maximum allowable variation (v_{min})
	( )	(v_{min})		
1				
2				
3				
4				
5				
6				
7				
8				

PASS: ☐ FAIL: ☐

Remarks: